The Ecological and Socioeconomic Determinants of Open Space Conversion: Policy Simulation Using Spatially Explicit Models

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The pace and ubiquity across the United States of farm and forestland conversion at the urban fringe has attracted the attention of academics, policy makers, and the public since at least the early 1980s. This trend has raised concern on several fronts because increasing urbanization affects habitat availability and critical ecosystem processes as well as public-sector expenditures for infrastructure and basic services.

This concern about the rate and extent of urban growth has incited a growing number of efforts to quantify its social and biophysical determinants. By combining longitudinal information retrieved from remote-sensing platforms with socioeconomic and geophysical variables, major advances have been made in recent years to model the human-environment interactions that drive land-use change. While much of this research has focused on identifying the factors explaining the spatial patterns of landscape development, less progress has been made on the role of temporal dynamics in the patterns that emerge. To the extent that both the location and timing of land-use conversion matter for assessing its determinants, this de-coupling of spatial and temporal dimensions compromises the implementation of appropriate policy responses to unchecked expansion of the built environment. There has also been little attention paid to how factors interact across multiple spatial, temporal, and political hierarchies. Since structured data are the norm for studies of land use, understanding land-use change processes at the micro level demands consideration of the larger contexts within which individual parcels are embedded.

My colleague (at the German Aerospace Center) and I contribute to the existing literature on land-use change in two key respects: by advancing an empirical model assessing how, over both time and space, land use at the rural-urban interface responds to changing economic and ecological conditions; and by exploring the implications for model estimation of ignoring the hierarchical structure of the data. In doing so, our research facilitates policy simulation to a far greater degree than land-use change models have to date.